

METHOD, APPARATUS, AND COMPUTER PROGRAM PRODUCT FOR WIRELESS SIGNALING

FIELD

[0001] The field of technology relates to wireless communication and more particularly to signaling mechanisms for wireless networks.

BACKGROUND

[0002] Modern society has adopted, and is becoming reliant upon, wireless communication devices for various purposes, such as connecting users of the wireless communication devices with other users. Wireless communication devices may vary from battery powered handheld devices to stationary household and/or commercial devices utilizing an electrical network as a power source. Due to rapid development of the wireless communication devices, a number of areas capable of enabling entirely new types of communication applications have emerged.

[0003] Cellular networks facilitate communication over large geographic areas. These network technologies have commonly been divided by generations, starting in the late 1970s to early 1980s with first generation (1G) analog cellular telephones that provided baseline voice communications, to modern digital cellular telephones. GSM is an example of a widely employed 2G digital cellular network communicating in the 900 MHz/1.8 GHz bands in Europe and at 850 MHz and 1.9 GHz in the United States. While long-range communication networks, like GSM, are a well-accepted means for transmitting and receiving data, due to cost, traffic and legislative concerns, these networks may not be appropriate for all data applications.

[0004] Short-range communication technologies provide communication solutions that avoid some of the problems seen in large cellular networks. Bluetooth™ is an example of a short-range wireless technology quickly gaining acceptance in the marketplace. In addition to Bluetooth™ other popular short-range communication technologies include Bluetooth™ Low Energy, IEEE 802.11 wireless local area network (WLAN), Wireless USB (WUSB), Ultra Wide-band (UWB), ZigBee (IEEE 802.15.4, IEEE 802.15.4a), and ultra high frequency radio frequency identification (UHF RFID) technologies. All of these wireless communication technologies have features and advantages that make them appropriate for various applications.

SUMMARY

[0005] Method, apparatus, and computer program product embodiments are disclosed for signaling mechanisms for wireless networks wherein wireless communications devices may perform a channel estimate transmission decision based on comparing current channel estimate to a previously sent channel estimate.

[0006] An example embodiment of the invention includes a method comprising:

[0007] transmitting, by an access node, a broadcast request message to one or more wireless terminal devices associated to a wireless network managed by the access node, to determine a distortion between a current channel estimate and the prior channel estimate and compare the determined distortion to a distortion threshold value included in the broadcast request message, the distortion threshold value being

included in the broadcast request message or in another message generated by the access node;

[0008] receiving, by the access node from a subset of the one or more wireless terminal devices, one or more parallel or sequential acknowledgement messages indicating presence of the determined distortion greater than the distortion threshold value or indicating an inability to determine a distortion in channel estimates, only if the determined distortion is greater than the distortion threshold value or if there is an inability to determine a distortion in channel estimates; and

[0009] transmitting, by the access node, one or more polling request messages, only to the subset of the one or more wireless terminal devices, to send the current channel estimate to the access node.

[0010] An example embodiment of the invention includes a method comprising:

[0011] wherein the broadcast request message is a null data packet announcement frame that includes the distortion threshold value set by the access node.

[0012] An example embodiment of the invention includes a method comprising:

[0013] wherein the one or more parallel acknowledgement messages, each include a short transmission pattern having a ZC-sequence identifying a sending one of the one or more wireless terminal devices.

[0014] An example embodiment of the invention includes a method comprising:

[0015] computing, by the access node, a ZC-sequence detection algorithm operating on the ZC-sequence received in each of the one or more parallel acknowledgement messages, to identify the one or more wireless terminal devices in the subset.

[0016] An example embodiment of the invention includes a method comprising:

[0017] wherein the one or more polling request messages comprises information indicating feedback request to different wireless terminal devices associated to the wireless network managed by the access node; and

[0018] receiving by the access node, one or more messages from the one or more wireless terminal devices, in response to the one or more polling request messages, including the current channel estimate.

[0019] An example embodiment of the invention includes a method comprising:

[0020] computing, by the access node, a precoding matrix based on stored channel estimates and the current channel estimates in the one or more messages received from the one or more wireless terminal devices; and

[0021] transmitting by the access node, one or more spatially multiplexed frames based on the computed precoding matrix, comprising data of one or more of the wireless terminal devices associated to the wireless network managed by the access node.

[0022] An example embodiment of the invention includes a method comprising:

[0023] storing, by a wireless device, a prior channel estimate that was previously transmitted to another wireless device in a wireless network;

[0024] receiving, by the wireless device, a request message from the other device, to determine a distortion between a current channel estimate and the prior channel estimate and compare the determined distortion to a distortion threshold value, the request message being a broadcast request message or a measurement request message and the distortion value